

I have much pleasure in thanking Mr. E. Everett for the assistance he has given me in the course of the preceding investigation.

- III. "On the Geometrical Construction of the Oxygen Absorption Lines Great A, Great B, and α of the Solar Spectrum." By GEORGE HIGGS. Communicated by R. T. GLAZEBROOK, F.R.S. Received February 20, 1893.

[Publication deferred.]

- IV. "Upon the Existence of more than one Fungus in Madura Disease (Mycetoma)." By RUBERT BOYCE, M.B., M.R.C.S., Assistant Professor of Pathology, University College, London, and NUSSERWANGI FAKIRGI SURVEYOR, M.D., M.R.C.P. Communicated by Professor VICTOR HORSLEY, F.R.S. Received February 21, 1893.

(From the Pathological Laboratory, University College, London.)

(Abstract.)

Nature of Mycetoma.—A very chronic, locally spreading inflammation of the foot, much less commonly of the hand; characterised by the destruction of the tissues, great overgrowth of granulation tissue, and by the presence of very numerous *brown-white*, fish-roe-like particles, or more rarely of *black* particles.

Views held concerning Mycetoma.—In 1874, Carter held that the "fungus foot" was a veritable parasitic disease, due to the growth and extension, within the tissues, of an "indigenous mould." He came to the conclusion that it was one species, the *Chionyphe Carteri*. Lewis and Cunningham (1888) concluded that mycetoma was "essentially a degeneration of the fatty tissues, independent of the local presence or influence of any parasites whatever." Bassini (1888) met with a case in Italy, the only one, as yet, observed in Europe, and concluded that the parasite was allied to the higher Fungi, either the Aspergilli or Mucorini. Most recently, Dr. Kanthack brought forward evidence to show the identity or close affinity of the parasite with that of actinomycosis.

Our Views.—That the black particles represent a curious metamorphosis of a large, branching, septate fungus; whilst the white particles consist largely of caseous material and of the remains of a lowly organised fungus, presenting in very many instances some of the characteristics of the fungus of actinomycosis. That both fungi are pathogenic. The following observations in support of these views are based upon an

examination of seven specimens of the black variety and of eighteen of the white, obtained from Bombay and from the various museums throughout the United Kingdom.

Black Variety.—Sections of the particles, free or *in situ* in the tissues, show that they are composed of tufts of a deep brown colour, and apart from a faint radiation or the presence of a slight venation or of holes, they give very little indication of a vegetable structure. By boiling the particles for from a few minutes to one hour in concentrated caustic potash, the brown colouring matter is very slightly removed, but this is completely discharged upon transferring them to distilled water; the fungus can then be readily studied. The animal tissues are however, destroyed by this process. If, however, the tissue containing the particles is embedded in collodion, washed for about one minute in "*eau de Javel*," and then stained, the colouring matter is removed from the fungus, and its relationship to the tissues around can be readily seen. The *fungus* appears the same in all the specimens of the black; the hyphæ radiate and branch, the segments vary very greatly in size; they may be spherical and reach a very great size, or long and slender; a pseudo-parenchyma may be formed in the centre of a tuft, or a palisade at the periphery. We have seen no organs of fructification. *Tissue reaction.*—The tufts are embedded in granulation tissue or necrosed material, and the presence of very large giant cells and other phagocytes is characteristic. The hyphæ may penetrate the vessels and run in their interior. The *metamorphosis* of the fungus appears to take place very early and affects equally the various hyphæ throughout the tissues. The nature and meaning of the change is very obscure. The dried particles burn with a luminous flame. Incinerated, there is a slight smell of burnt feathers, and in the ash, which is very little, there is a brown coloration, owing to the presence of iron; the presence of the latter may be confirmed in the unclarified and clarified specimens by the Prussian blue test. The iron is, however, limited to the periphery of the tufts, and appears wholly derived from the animal tissues. The particles give a red reaction with dilute nitric and hydrochloric acids: little impression is produced upon them by boiling in the various fat solvents; they give no special reactions with ferric chloride or cupric acetate (resin test).

White Variety.—Sections of the particles are characteristic. In the centre are usually numerous small reniform deeply-staining masses, surrounded by a deep radiate zone. In the central bodies a very fine reticulum may occasionally be made out; more usually, stronger evidence of the fungus is obtained by the presence of dwarfed club-like hyphæ, which form an irregular fringe to the reniform bodies. It is exceedingly difficult to ascertain what gives rise to the deep radiate zone; the leucocytes in it are compressed, yet the compressing

hyphæ remain for the most part unstained. The fungus undergoes very early degeneration. *Tissue reaction*.—The particles are surrounded by leucocytes and are either embedded in granulation tissue or lie free in the abscess cavities or sinuses.

In both varieties the spread of the particles and inflammation goes hand in hand, and a recurrence of the particles and of the inflammation has been observed by one of us in the scar left after amputation for the black variety of fungus foot.

Presents, March 9, 1893.

Transactions.

- Baltimore:—Johns Hopkins University. Circulars. Vol. XII. No. 102. 4to. *Baltimore* 1893; Annual Report. 1892. 8vo. *Baltimore* 1892. The University.
- Bergen:—Museum. Aarsberetning. 1891. 8vo. *Bergen* 1892. The Museum.
- Cambridge, Mass.:—Harvard University. Bulletin. Vol. VII. No. 2. 8vo. [*Cambridge* 1893.]
- Leipsic:—Königl. Sächsische Gesellschaft der Wissenschaften. Abhandlungen. Philol.-Histor. Classe. Band XIII. No. 5. 8vo. *Leipzig* 1893. The Society.
- Liverpool:—Liverpool Marine Biology Committee. Sixth Annual Report. 8vo. *Liverpool* 1893. The Committee.
- London:—British Astronomical Association. Journal. Vol. III. No. 2. 8vo. *London* 1893; Memoirs. Vol. I. Part 5. 8vo. *London* 1893. The Association.
- Geologists' Association. Proceedings. Vols. I. Nos. 8—11. II—VI. VII. Nos. 1, 4—7. VIII—XII. XIII. Part 1. 8vo. *London* 1862—93. The Association.
- Institute of Brewing. Transactions. Vol. VI. No. 4. 8vo. *London* 1893. The Institute.
- Royal Horticultural Society. Journal. Vol. XV. Parts 2—3. 8vo. *London* 1893. The Society.
- Royal United Service Institution. Journal. Vol. XXXVII. No. 179. 8vo. *London* 1893. The Institution.
- Society of Biblical Archaeology. Proceedings. Vol. XV. Part 3. 8vo. *London* 1893. The Society.
- Lyons:—Université. Annales. Tome II. Fasc. 4. Tome IV. Tome VI. Fasc. 1—2. 8vo. *Paris* 1892—93. The University.
- Milan:—Società Italiana di Scienze Naturali. Atti. Vol. XXXIV. Fasc. 1. 8vo. *Milano* 1892. The Society.
- Pisa:—Società Toscana di Scienze Naturali. Processi Verbal. Dicembre, 1892. 8vo. [*Pisa*.] The Society.